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(54)【発明の名称】　ビーム分配装置

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【特許請求の範囲】

【請求項１】加速器で加速された荷電粒子を複数の治療室に分配する複数個の偏向電磁石を、切換器を介して共通の励磁電源に電気的に接続し、上記切換器の切換動作に対応した治療室にのみ上記荷電粒子が照射されるようにしたビーム分配装置。

【請求項２】加速器で加速された荷電粒子を複数の治療室に分配する複数個の偏向電磁石を、切換器を介して共通の励磁電源に電気的に接続し、上記切換器の切換動作と治療室患者セット完了信号とのインターロックをとる構成とし、上記切換器の切換動作に対応した治療室にのみ上記荷電粒子が照射されるようにしたビーム分配装置。

【発明の詳細な説明】

〔発明の技術分野〕

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本発明は加速器で加速された荷電粒子を複数の治療室に分配するビーム分配装置に関する。

〔発明の技術的背景〕

近年、医療分野においては加速器で加速された荷電粒子（ヘリウムHe，炭素Ｃ，ネオンNe，ケイ素Si，アルゴンAr等のイオン）いわゆるビームを例えばがん患部に照射して治療に用いることが検討され始めている。これに用いる装置として荷電粒子を偏向電磁石によりいくつかに分配するビーム分配装置が採用されてきている。

第２図は従来のビーム分配装置の概要を示すものであり、線型加速器（ライナック）１で加速された荷電粒子をシンクロトロン２でさらに所定のエネルギーまで加速し、例えば３組の偏光電磁石３，４，５により３つの治療室１，２，３に分配し、がん患部に照射して治療に利用するものである。

このような構成のものにおいて、シンクロトロン2からの荷電粒子はほぼ連続的に出射されるので、できるだけ多くの治療室を設け、荷電粒子をタイムシエアリングして同時に多数の患者を照射すれば、ビーム分配装置の有効利用が図れる。しかし、一般に数百MeVのイオンがもしがん患部以外の正常（細胞）組織に誤照射されると、その正常組織が破壊されてしまい人体の安全をおびやかすことになる。

〔発明の目的〕

本発明は上記事情にもとづいてなされたもので、患者に対する安全性が高くなり、しかも経済的にも有利となるビーム分配装置を提供することを目的とする。

〔発明の概要〕

本発明は上記目的を達成するため以下のように構成したものである。すなわち、第1番目の発明は加速器で加速された荷電粒子を複数の治療室に分配する複数個の偏向電磁石を切換器を介して共通の励磁電源に電気的に接続したものである。第2番目の発明は加速器で加速された荷電粒子を複数の治療室に分配する複数個の偏向電磁石を、切換器を介して共通の励磁電源に電気的に接続し、上記切換器の切換動作と治療室患者セット完了信号とのインターロックをとる構成としたものである。

〔発明の実施例〕

以下、本発明の実施例について第1図を参照して説明する。線型加速器1で加速された荷電粒子をシンクロトロン2でさらに所定のエネルギーまで加速し、偏向電磁石3，4，…iにより治療室1，2，…nに分配可能に構成してある。[redacted]

さらに上記荷電粒子のうち治療に使用されないものは、ビームタンパ8で減衰させるようにしてある。

[redacted]

なわち、上記した従来装置にあっては荷電粒子が治療室1～nのすべてに同時に照射されることから、患者が治療台にセットされない状態あるいはセット中のとき誤照射されるおそれがあるが、本発明装置では特定の治療室にしか荷電粒子が照射されないので、特定の治療室以外の治療室にいる患者は危険性が全くなく、又特定の治療室内の患者も治療台にセットされた状態で荷電粒子の照射が可能となることから安全性が増す。また、偏向電磁石1～iの励磁電源7が共通であるので、偏向電磁石1～i毎に励磁電源を設けるものに比べて経済的にも有利となる。

次に上記した実施例に次のような構成を追加することによりさらに患者に対する安全性が増す。すなわち、各治療室1～nから切換器6に対して患者セット完了状態を知らせる装置を設け、この装置からの患者セット完了信号が生じたときのみ、これに対応する偏向電磁石1～iのいずれかに励磁電源7が接続されるように、上記切換器6の切換動作が可能な構成とする。

このようにすることにより、治療台にセットされない状態の患者に荷電粒子が照射されることがないことから、上記実施例に比べてさらに安全である。またどの治療室1～iからも患者セット完了信号がない場合には切換器6を開放状態になるようにすれば荷電粒子の誤照射が完全になくなる。

〔発明の効果〕

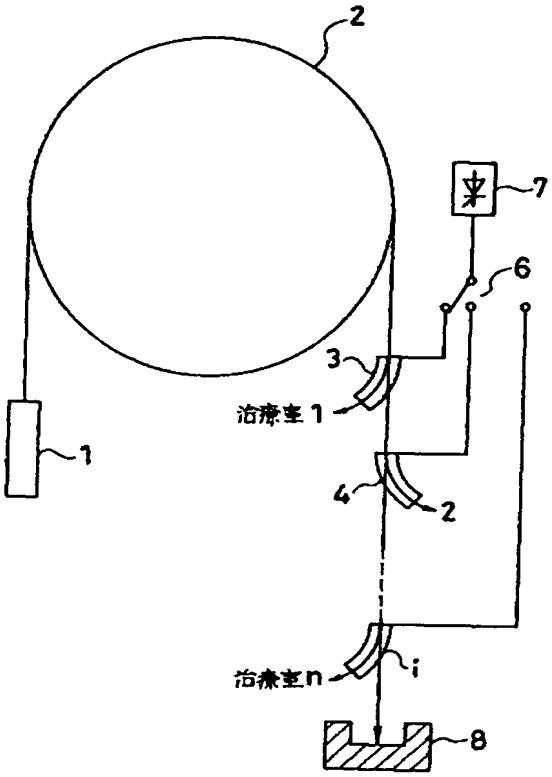
以上述べた本発明によれば患者に対する安全性が高くなり、しかも経済的にも有利となるビーム分配装置を提供できる。

【図面の簡単な説明】

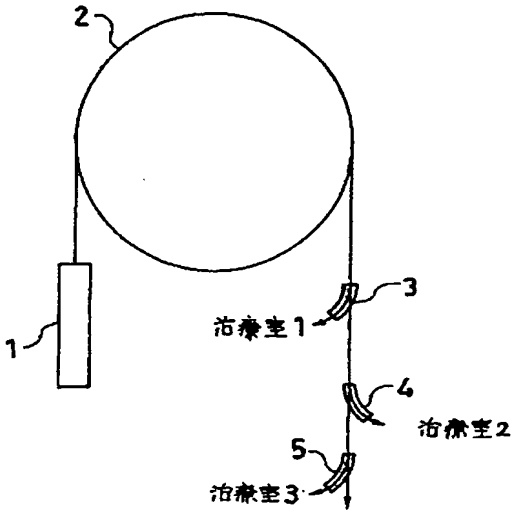
第1図は本発明によるビーム分配装置の一実施例を説明するための概略図、第2図は従来のビーム分配装置の一例を説明するための概略図である。

1……加速器、2……シンクロトロン、3，4，…i……偏向電石磁、6……切換器、7……励磁電源。

【第１図】



【第２図】



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Applicant: Toshiba Corporation
Inventor: Yoshihisa Sato
Title of Invention: Beam Distribution System

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CLAIMS

[Claim(s)]
[Claim 1] Beam distribution apparatus by which connect electrically to a common excitation power source two or more deflection electromagnets which distribute the charged particle accelerated with the accelerator to two or more treatment rooms through a change-over machine, and it was made for the above-mentioned charged particle to be irradiated by only the treatment room corresponding to change-over actuation of the above-mentioned change-over machine.
[Claim 2] Beam distribution apparatus by which connect electrically to a common excitation power source two or more deflection electromagnets which distribute the charged particle accelerated with the accelerator to two or more treatment rooms through a change-over machine, carry out as the configuration which takes interlocking with change-over actuation of the above-mentioned change-over machine, and a treatment room patient set complete signal, and it was made the above-mentioned charged particle to be irradiated by only the treatment room corresponding to change-over actuation of the above-mentioned change-over machine.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[Field of the Invention]
This invention relates to the beam distribution apparatus which distributes the charged particle accelerated with the accelerator to two or more treatment rooms.
[Background of the Invention]
the charged particle (ion, such as Helium helium, Carbon C, Neon Ne, silicon Si, and Argon Ar) accelerated with the accelerator in the medical field in recent years -- irradiating for example, the cancer affected part and using the so-called beam for a therapy is beginning to be examined. The beam distribution apparatus which distributes a charged particle to some with a deflection electromagnet as equipment used for this has been adopted.
Drawing 2 shows the outline of the conventional beam distribution apparatus, and accelerates the charged particle accelerated with the linear accelerator (linac) 1 to energy further predetermined with a synchrotron 2, for example, distributes it to three treatment rooms 1, 2, and 3 with 3 sets of polarization electromagnets 3, 4, and 5, irradiates the cancer affected part, and is used for a therapy.
In the thing of such a configuration, since outgoing radiation of the charged particle from a synchrotron 2 is carried out almost continuously, as many treatment rooms as possible are prepared, and if time sharing of the charged particle is carried out and many patients are irradiated simultaneously, a deployment of beam distribution apparatus can be aimed at. However, if the ion of hundreds MeV(s) is generally incorrect-irradiated by the normal (cell) organization of those other than the cancer affected part, the normal tissue will be destroyed and the insurance of the body will be threatened.
[Objects of the Invention]
This invention was made based on the above-mentioned situation, and aims at the safety to a patient offering the beam distribution apparatus which becomes high and moreover becomes advantageous also economically.
[Summary of the Invention]
This invention is constituted as follows in order to attain the above-mentioned object. That is, the 1st invention connects electrically to a common excitation power source two or more deflection electromagnets which distribute the charged particle accelerated with the accelerator to two or more treatment rooms through a change-over machine. The 2nd invention connects electrically to a common excitation power source two or more deflection electromagnets which distribute the charged particle accelerated with the accelerator to two or more treatment rooms through a change-over machine, and is taken as the configuration which takes interlocking with change-over actuation of the above-mentioned change-over machine, and a treatment room patient set complete signal.
[Example]
Hereafter, the example of this invention is explained with reference to drawing 1 . The charged particle accelerated with the linear accelerator 1 is accelerated to energy further predetermined with a synchrotron 2, and the deflection electromagnets 3 and 4 and --i constitute possible [distribution] in treatment rooms 1 and 2 and --n. And the above-mentioned deflection

electromagnets 3 and 4 and —i are electrically connected to the common excitation power source 7 through the change-over machine. It is made to have attenuated what furthermore is not used for a therapy among the above-mentioned charged particles by the beam tamper 8. Thus, since it is constituted, and the charged particle distributed by one of the deflection electromagnet 3 connected with the contact of the change-over machine 6 — i is irradiated by only one in a treatment room 1 — n, its safety to a patient improves. Namely, although there is a possibility of incorrect-irradiating when it is under the condition that a patient is not set to a dental chair, or set since a charged particle is simultaneously irradiated by all of treatment rooms 1 – n, if it is in equipment conventionally [above-mentioned] Since a charged particle is irradiated by only the specific treatment room with this invention equipment, and the exposure of a charged particle of the patient who is present in treatment rooms other than a specific treatment room is attained where it is safe and the patient in a specific treatment room is also set to a dental chair, safety increases. Moreover, since the excitation power source 7 of the deflection electromagnet 1 – i is common, also economically compared with what prepares an excitation power source in every deflection electromagnet 1 – i, it becomes advantageous.
Next, the safety to a patient increases further by adding the following configurations to the above-mentioned example. That is, only when the equipment which tells a patient set complete condition from each treatment room 1-n to the change-over machine 6 is formed and the patient set complete signal from this equipment arises, it considers as the configuration in which change-over actuation of the above-mentioned change-over machine 6 is possible so that the excitation power source 7 may be connected to either the deflection electromagnet 1 corresponding to this – i.
Since a charged particle is not irradiated by the patient in the condition of not being set to a dental chair by doing in this way, compared with the above-mentioned example, it is still safer.
Moreover, if the change-over machine 6 is made to be in an open condition also from which treatment room 1-i when there is no patient set complete signal, the incorrect exposure of a charged particle will be lost thoroughly.
[Effect of the Invention]
According to this invention described above, the beam distribution apparatus from which the safety to a patient becomes high and moreover becomes advantageous also economically can be offered.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
A schematic diagram for drawing 1 to explain one example of the beam distribution apparatus by this invention and drawing 2 are schematic diagrams for explaining an example of the conventional beam distribution apparatus.
1 [.. A change-over machine, 7 / .. Excitation power source] .... An accelerator, 2 .. A synchrotron, 3 and 4, --i .. Deflection ******, 6

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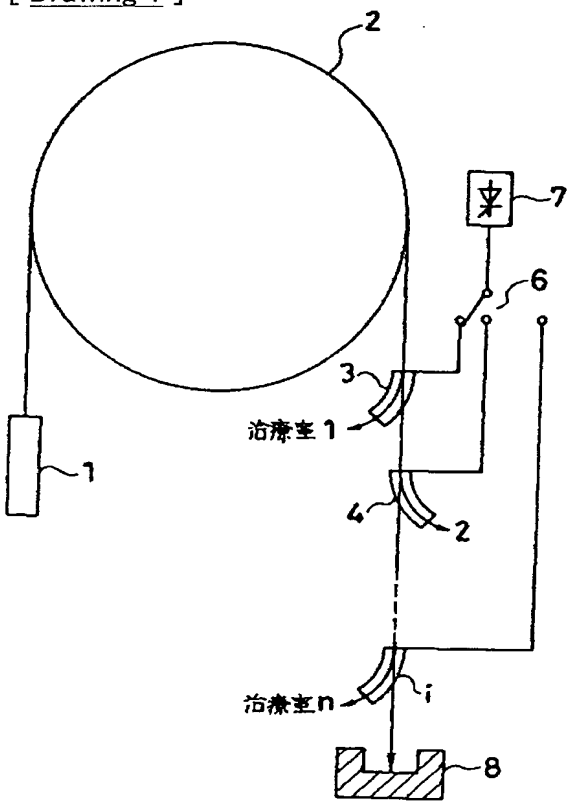
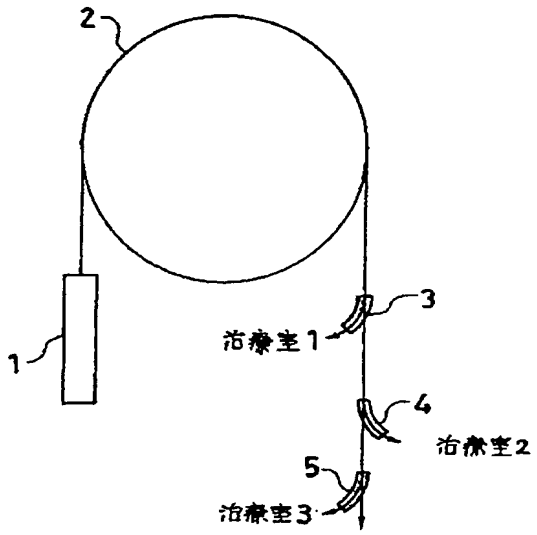
DRAWINGS

[Drawing 1]



[Drawing 2]



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